



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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| <p>(51) International Patent Classification <sup>6</sup> :<br/>B08B 3/04, 3/06, 3/08, B29B 17/02</p>   | <p>A1</p> | <p>(11) International Publication Number: <b>WO 99/25493</b></p> <p>(43) International Publication Date: 27 May 1999 (27.05.99)</p>   |
| <p>(21) International Application Number: PCT/NZ98/00157</p> <p>(22) International Filing Date: 30 October 1998 (30.10.98)</p> <p>(30) Priority Data:<br/>329206 19 November 1997 (19.11.97) NZ</p> <p>(71)(72) Applicant and Inventor: SCHWASS, Eric, Winston<br/>[NZ/NZ]; 137 Smart Road, P.O. Box 3398, New Plymouth<br/>4615 (NZ).</p> <p>(74) Agents: SIMS, Anthony, W. et al.; 29 Clarence Street, P.O.<br/>Box 759, Hamilton 2001 (NZ).</p> |           | <p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published<br/>With international search report.<br/>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p> |
| <p>(54) Title: IMPROVEMENTS IN RECYCLING METHODS</p> <div> </div> <p>(57) Abstract</p> <p>The present invention relates to improved methods of treating products to be recycled. In the preferred embodiment, plastic is agitating in a cleaning solution to remove contaminants before the plastic is used in a recycled application.</p>  |           |   |

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## IMPROVEMENTS IN RECYCLING METHODS

### TECHNICAL FIELD

This invention relates to improvements in methods of recycling.

In particular, the invention relates to improvements to the method of  
5 plastic recycling for removing contaminants.

Reference to plastic recycling should not be seen to be limiting the scope of the present invention's manufacture or use as the principles of the present invention may be applied to the recycling or removal of contaminants from other materials.

### 10 BACKGROUND ART

Developments in processes of recycling plastic have become important because the raised awareness of environmental issues that face today's society.

It is well known that it is desirable that our society reduces the  
15 amount of waste it produces, particularly plastic waste.

One problem that plastic recycling manufacturers have faced, is that some waste plastic to be recycled or has been used in applications that have left contaminants on the plastic.

Such contaminants may be oil, toxic chemicals, or other hazardous  
20 substances.

It is important that these substances are removed from the plastic before the plastic is recycled or re-used and used in other areas, to

prevent further contamination.

Such other areas could be remoulding in the case of thermo plastics. Other uses include producing plastic for landfill. Landfill material must not have contaminants. Contaminants would otherwise leak into  
5 the soil.

Current methods of recycling plastic do not adequately or efficiently address the residual contaminant problem.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

10 Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

#### **DISCLOSURE OF INVENTION**

According to one aspect of the present invention there is provided a  
15 method of treatment of material to remove contaminants, characterised in the steps of

- i) placing the material to be treated into a container,
- ii) adding a solvent,
- iii) agitating the container,
- 20 iv) draining the solvent and impurities from the container,
- v) repeating steps (i) to (iv) above as many times as necessary to achieve the desired result.

In preferred embodiments, the treatment of the material may be recycling.

Reference to re-cycling should not be seen to be limiting the scope of the present invention's manufacture or use, as one skilled in the art  
5 will appreciate that the principles of the present invention may be applied to other treatment processes and methods, such as sterilisation, cleaning and so forth.

In a preferred embodiment, the material to be recycled may be plastic.

Reference to plastic should not be seen to be limiting the scope of the  
10 present invention's manufacture or use, as one skilled in the art will appreciate that the principles of the present invention may be applied to the recycling of other material such as paper, glass, wood and so forth.

In a further preferred embodiment, the plastic may be shredded or  
15 granulated before introduction of the solvent, or introduction to the container.

The advantage of granulating or shredding the plastic is that it ensures a maximum surface area of the plastic is exposed to the solvent. This maximises the removal of the contaminants from the  
20 plastic.

Reference to contaminants shall now be made with reference to oil.

Reference to oil should not be seen to be limiting the scope of the present inventions manufacture or use, as the present invention may be used to extract other contaminants as the situation may require.

The contaminants may include other carbon compounds, chemicals, organic matter, in-organic matter and so forth.

The solvent to be applied in the process of the present invention, may be any suitable solvent that will help liberate the contaminant from the plastics. For example, the solvent may be a detergent, water, chemical mix, or some other solvent.

In preferred embodiments however, the solvent to be applied may be water with a detergent additive.

The container used may be any suitable container with the dimensions and structural integrity to contain the plastics material with the solvent.

In preferred embodiments however the container may be an industrial hopper with a lid. The advantage of using a container with a lid is that when the container is agitated, the solvent and material being treated will not be forced over the edge of the container by the agitation motion.

The agitation motion may be obtained by any apparatus suitable for the task of agitation, such as a vibration machine, a machine that provides alternating movement or an agitating member extending into the plastic/solvent mix.

The advantage of agitating the container is that the interaction between the solvent and the granulated or shredded plastic is increased. This allows an increase in the surface area of the plastic that comes in contact with the solvent.

Thus, a greater amount of contaminant is removed from the plastic due to the aggressive rubbing action between solvent and plastic, resulting from the agitation.

Preferably, there may be associated with the container at least one  
5 screen mesh separating an upper portion of the container from a lower portion.

Preferably, the granulated plastic may be placed in the area defined by the container above the mesh.

Preferably, the area defined by the container underneath the mesh  
10 may contain the collection of the solvent.

There may also be associated with the apparatus, pumps to pump the solvent to a location where it may be introduced to the plastic.

In some preferred embodiments, the present invention may include the extra step of rinsing the plastics after they have been treated by the  
15 solvent.

Preferably, the step of rinsing may be performed by substantially the same apparatus as applies the solvent to the plastic described above.

However, the step of rinsing may be performed by water only to wash away any residual oil.

20 The rinsing step may be repeated as many times as necessary to achieve the desired state in the plastic.

In a further preferred embodiment, the process may include the step of drying the plastic.

Preferably, the means for placing the plastics into the container and subsequently moving the plastics from the container to a rinsing tank may be by means of a pump system.

5 The advantage of using a pump system is that the solvent and plastic mix is contained entirely within the system, without risk of spilling any solvent or plastic granules.

The use of a pump should not be seen to be limiting the scope of the present invention's manufacture or use, as one skilled in the art will appreciate that other means of moving the plastic and solvent mix  
10 through the system may be used.

For example, there may be employed a gravity feed, a conveyer belt, or some roller system.

The advantage of using a pump is that it enables rapid transfer of the plastic between the stages. Another advantage is that the use of a  
15 pump enables the system to be contained, with no spill over or splatter.

The advantages of the present invention include an improved quality of recycled plastic. Any contaminants such as oil residue from oil containers are removed from the plastic. The plastic may therefore be reused in a wider variety of situations. If the plastic is used in landfill,  
20 the contaminants will not leach into the soil.

Another advantage is that the contaminant may be collected and re-used elsewhere, depending on the nature of the contaminant. For example, if the contaminant is oil, it may be collected and re-used in another application.

The agitation feature of the present invention enables a greater surface area of the plastic to be treated by the solvent, consequently resulting in a higher percentage of plastic with contaminant removed.

#### **BRIEF DESCRIPTION OF DRAWINGS**

- 5 Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

Figure 1 shows a schematic view of the process of the present invention.

#### **10 BEST MODES FOR CARRYING OUT THE INVENTION**

With reference to Figure 1 there is shown a plastic recycling process indicated by general arrow 1.

- The components used in the process comprise a mulcher or shredder 2, first agitator 3, second agitator 4, third agitator 5, fourth agitator 6,  
15 cleaning solution tank 7, rinse tank 8, second rinse tank 9, and third rinse tank 10.

Each of the agitators include a mesh screen 11. Cleaning solution tank 7 contains cleaning solution 12, and rinse tanks 8, 9, and 10 contain rinsing solution 13.

- 20 Also included are pumps 14 and mixes 15.

In operation, the process is as follows.

The plastic to be recycled (not shown) is mulched or shredded or granulated by mulcher 2. The plastic 2 is moved to agitator 3. Pump

14 causes cleaning solution 12 to be sprayed over the plastic that is contained in agitator 3. Agitator 3 provides a simultaneous agitating motion.

5 The plastic is supported on screen mesh 11, and consequently the contaminant residue and used cleaning solution 12 drains through the mesh 11 and settles in cleaning solution tank 7.

The contaminant residue (not shown) will most often settle on the surface of the cleaning solution 12.

10 The settled contaminant residue may be skimmed from the surface of the cleaning solution 12.

The plastic is then moved to agitator 4 via mixer 15 and pump 14. The plastic is supported in agitator 4 on a screen mesh 11. Rinsing solution 13 is pumped from rinsing tank 8 by pump 14 to the agitator 4, where it is sprayed over the plastic.

15 The agitator 4 provides a simultaneous agitation motion.

Contaminant residue (not shown) and used rinsing solution 13 drains through screen mesh 11 into rinsing tank 8.

Residue still present is skimmed of the top of the rinsing solution 13.

20 The rinsing process is repeated twice using the remaining components of the process, namely agitator 5, rinsing tank 9, and cleaning solution 13. The second repetition involves agitator 6, rinsing tank 10, and rinsing solution 13.

The resulting processed plastic (not shown), is then dried in dryer 7

and bagged in bagging area 16.

The plastic is then ready for use in various applications.

In each of the steps involved, the agitation motion combined with the spraying of the various solutions results in the granulated or shredded

5 plastic having contaminants removed from it.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof as defined in the appended claims.

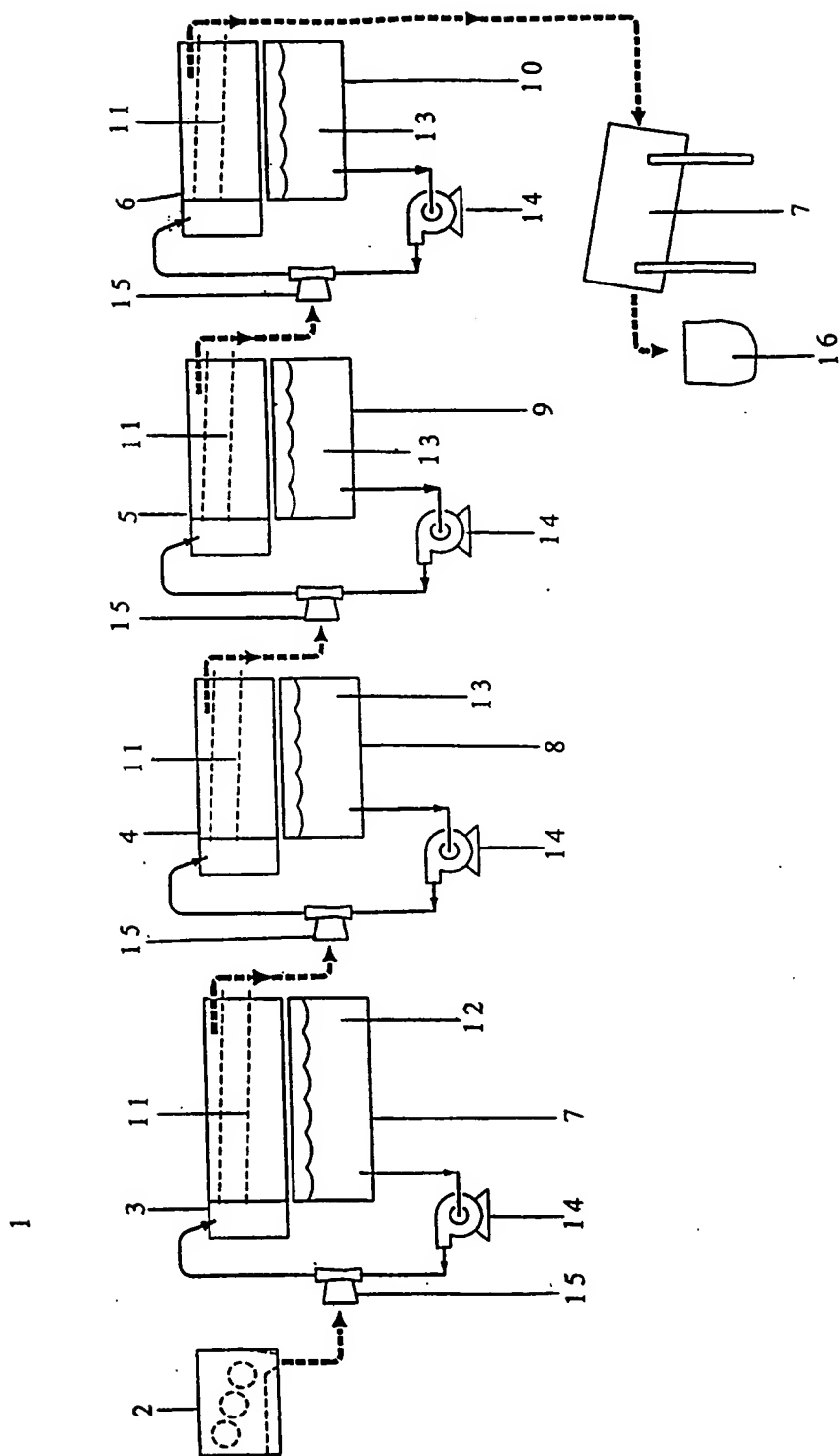
WHAT I CLAIM IS:

1. A method of treatment of material to remove contaminants therefrom, characterised in the steps of:
  - (i) Placing the material to be treated into a container,
  - (ii) Adding a solvent,
  - (iii) Agitating the container,
  - (iv) Draining the solvent and impurities from the container.
2. A method according to claim 1, including the additional step of repeating steps 1 to 4 until the desired amount of contaminants has been removed.
3. A method according to claims 1 and 2 wherein the material is plastic.
4. A method as claimed in claims 1 to 3 wherein the plastic is shredded prior to step 1.
5. A method according to any one of claims 1 to 4 wherein the material is granulated prior to step 1.
6. A method according to any one of claims 1 to 5 wherein the solvent includes water.
7. A method as claimed in any one of claims 1 to 6 wherein the solvent includes a detergent.
8. A method according to claims 1 to 7 wherein the contaminant includes oil.
9. A method according to any one of claims 1 to 8 wherein the container is a hopper.

10. A method according to any one of claims 1 to 9 wherein the container includes a lid.
11. An apparatus for carrying out any of the methods claimed in claims 1 to 11, the apparatus including a container, an agitator for agitating the container and/or the contents thereof.
12. A method as substantially herein described and illustrated by the accompanying drawing.
13. An apparatus as previously herein described and illustrated by the accompanying drawing.

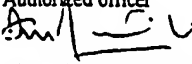
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FIG 1/1



# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/NZ 98/00157

| <b>A. CLASSIFICATION OF SUBJECT MATTER</b>   |   |  |   |   |
|--|---|--|---|---|
| Int Cl <sup>6</sup> : B08B 3/04, 3/06, 3/08; B29B 17/02  |   |  |   |   |
| According to International Patent Classification (IPC) or to both national classification and IPC  |   |  |   |   |
| <b>B. FIELDS SEARCHED</b>  |   |  |   |   |
| Minimum documentation searched (classification system followed by classification symbols)<br>IPC: B08B 3/04, 3/06, 3/08; B27B 17/02; B29C 29/00  |   |  |   |   |
| Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  |   |  |   |   |
| Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)<br>WPAT: IPC as above and (shred: or chop: or clean: or wash:)<br>JAPIO: IPC as above and (shred: or chop: or clean: or wash )  |   |  |   |   |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>  |   |  |   |   |
| Category*  | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No.  |   |   |
| X  | US 4379525 A (NOWICKI et al) 12 April 1983<br>Figures, claims   | 1-13   |   |   |
| X  | US 4760717 A (PONZIELLI) 2 August 1988<br>Abstract, claims, Figures   | 1-13   |   |   |
| X  | US 5443652 A (SCAROLA et al) 22 August 1995<br>Abstract, claims, Figures  | 1-13   |   |   |
| X  | US 3852046 A (BROWN) 3 December 1974<br>Abstract, claims  | 1-13   |   |   |
| <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex  |   |  |   |   |
| <p>* Special categories of cited documents:</p> <table border="0"> <tr> <td style="vertical-align: top;"> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="vertical-align: top;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p> </td> </tr> </table> |   |  | <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> | <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p> |
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| Date of the actual completion of the international search<br>8 April 1999  |   | Date of mailing of the international search report<br>15 APR 1999  |   |   |
| Name and mailing address of the ISA/AU<br>AUSTRALIAN PATENT OFFICE<br>PO BOX 200<br>WODEN ACT 2606<br>AUSTRALIA<br>Facsimile No.: (02) 6285 3929   |   | Authorized officer<br><br>KUMUDU RAMASUNDARA<br>Telephone No.: (02) 6283 2155 |   |   |

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ 98/00157

| C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT |  |                       |
|---|--|-----------------------|
| Category*   | Citation of document, with indication, where appropriate, of the relevant passages       | Relevant to claim No. |
| X   | US 4033907 A (WOLF) 5 July 1977<br>Abstract, claims, Figures                             | 1-13                  |
| X   | US 5174316 A (KELLER et al) 29 December 1992<br>Abstract, claims, Figures                | 1-13                  |
| X,P   | US 5714070 A (LORENZ) 3 February 1998<br>Abstract, claims, Figures                       | 1-13                  |
| X   | US 5368796 (LORENZ) 29 November 1994<br>Abstract, claims, Figures                        | 1-13                  |
| X   | DE 3543892 A (ALUPLAST ALUMINIUM PLASTIC RECYCLING GmbH) 19 June 1987<br>Claims, Figures | 1-13                  |
| X   | EP 0090372 A (ALUPLAST GmbH) 5 October 1993<br>Claims, Figures                           | 1-13                  |

## INTERNATIONAL SEARCH REPORT

### Information on patent family members

International application No.  
PCT/NZ 98/00157

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

| Patent Document Cited in Search Report |         |      | Patent Family Member |    |         |    |         |
|--|---------|------|----------------------|----|---------|----|---------|
| US                                     | 4379525 | NONE |                      |    |         |    |         |
| US                                     | 4760717 | AT   | 25/85                | BR | 8500086 | DE | 3500082 |
|  |         | ES   | 539406               | ES | 8601359 | FR | 2557830 |
|  |         | IT   | 1218840              | SE | 8500067 |    |         |
| US                                     | 5443652 | NONE |                      |    |         |    |         |
| US                                     | 3852046 | NONE |                      |    |         |    |         |
| US                                     | 4033907 | NONE |                      |    |         |    |         |
| US                                     | 5174316 | NONE |                      |    |         |    |         |
| US                                     | 5714070 | CA   | 2129451              | DE | 4342848 | EP | 602658  |
|  |         | WO   | 94/14883             |    |         |    |         |
| US                                     | 5368796 | CA   | 2091069              | DE | 4122277 | EP | 521418  |
|  |         | WO   | 93/01036             |    |         |    |         |
| DE                                     | 3543892 | NONE |                      |    |         |    |         |
| EP                                     | 0090372 | DE   | 3210976              | ZA | 8302061 |    |         |
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